

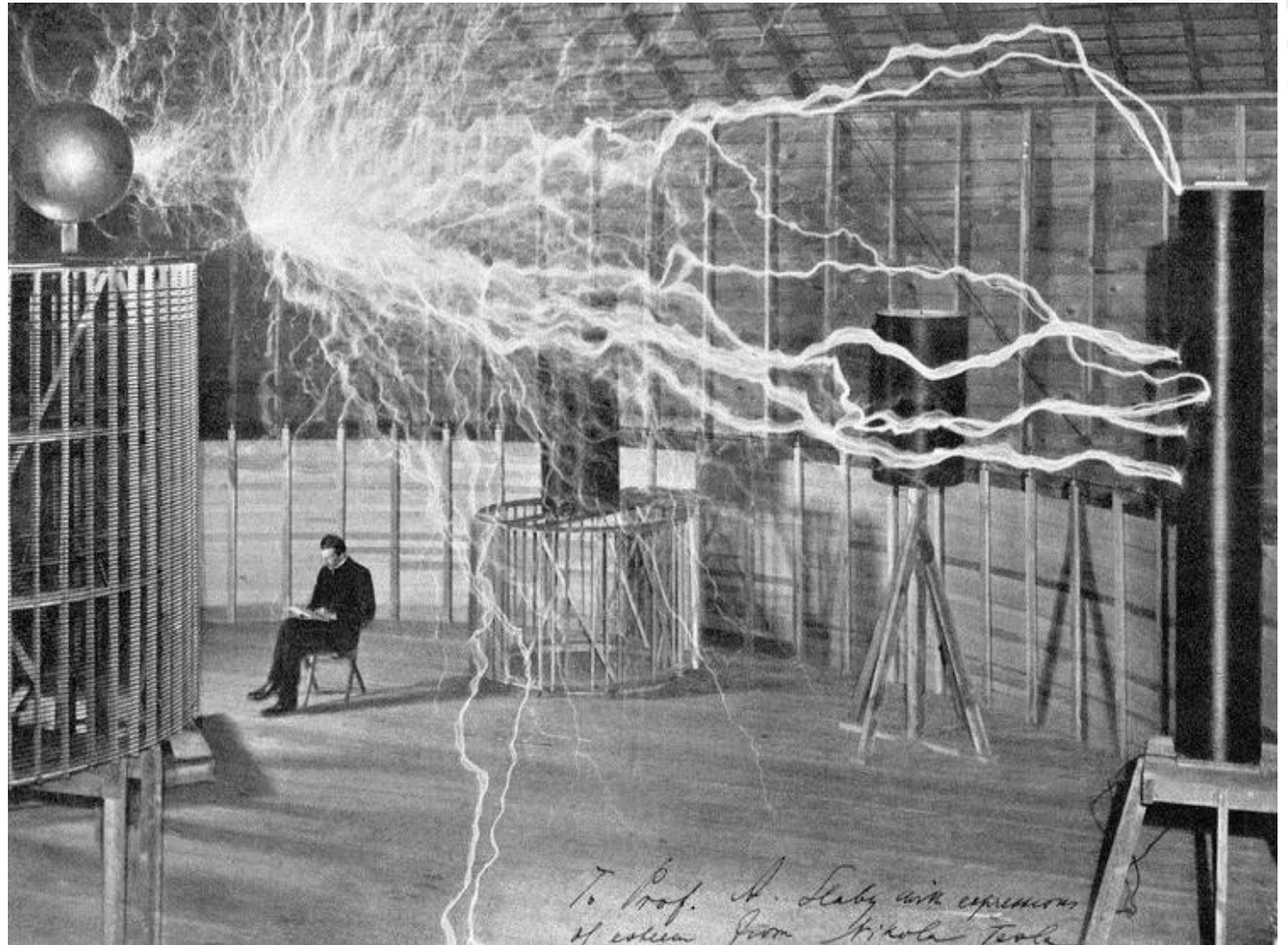
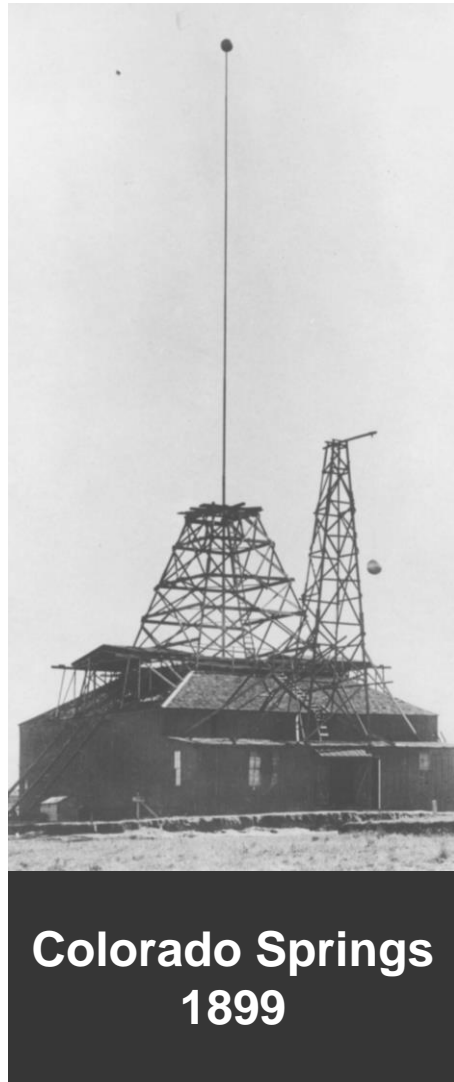
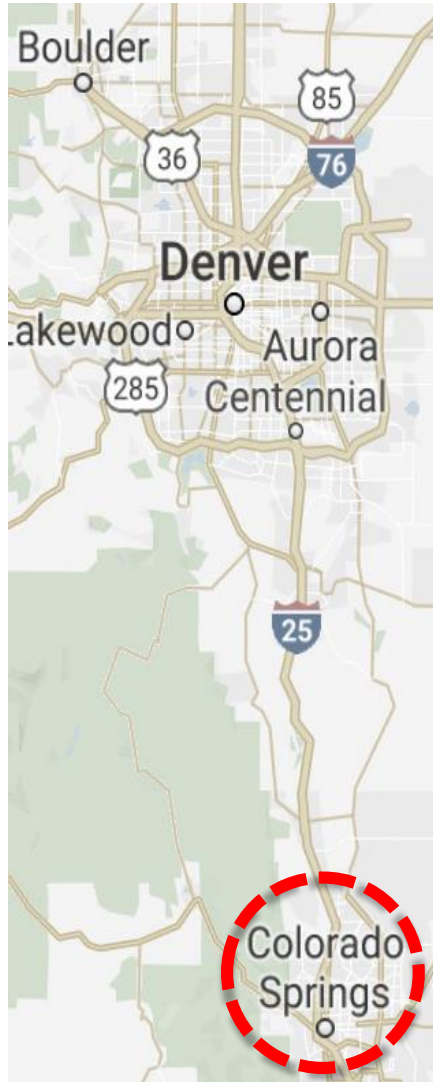
Lunar Energy *(seriously!!)*



Dr. Mario Garcia-Sanz
ARPA-E Program Director
U.S. Department of Energy

Denver, Colorado, July 9th, 2019

Nikola Tesla: *"To harness the energies of nature to the service of humanity"*



Question: Which is that ideal “*source of energy to service humanity*”



Answer: is this **Tidal Energy?**

Unlimited resources

Enormous. Larger than described in publications

Technically achievable

Intersection of Wind & Marine Engineering

Economically attractive (LCOE)

Still expensive LCOE. See next

Precise generation prediction. No uncertainty

Like a clock. Moon/Sun/Topology

Environmentally friendly. Low visual impact and use of land

In the water. Low risk for fish

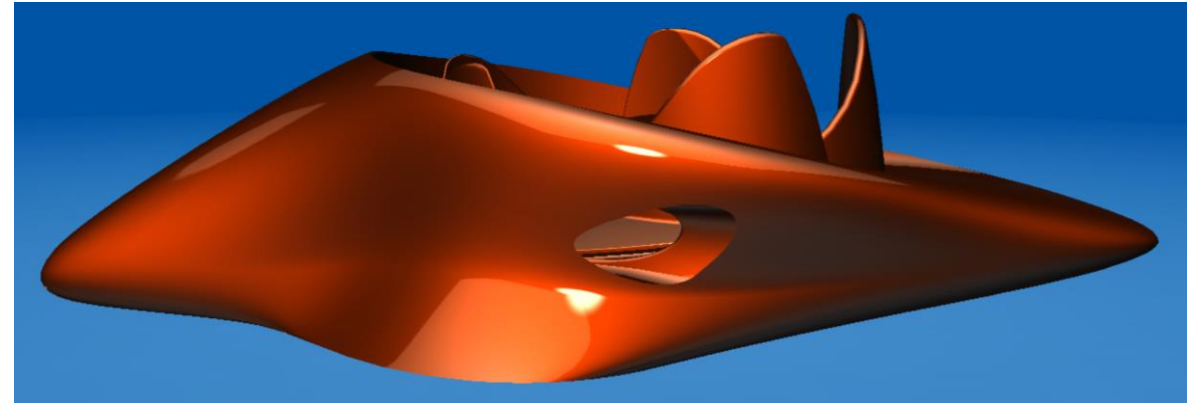
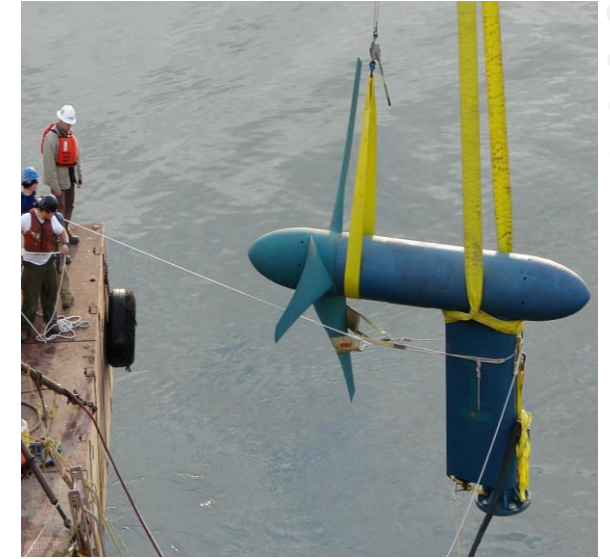
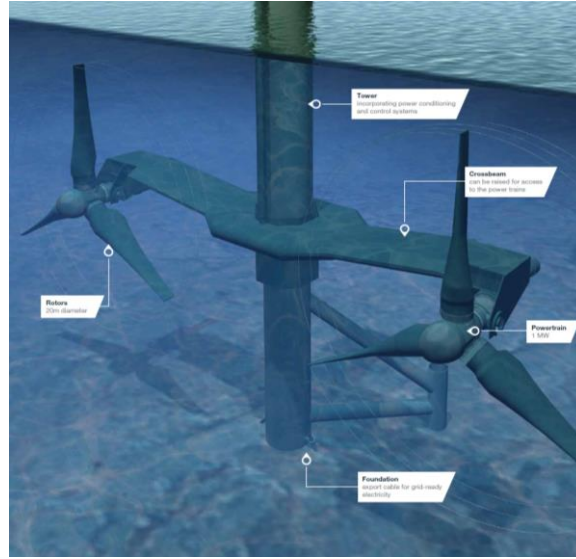
Long-term survivability. No risk of extreme weather conditions

Protected at seabed

Opens new space for small business, with great potential economic impact

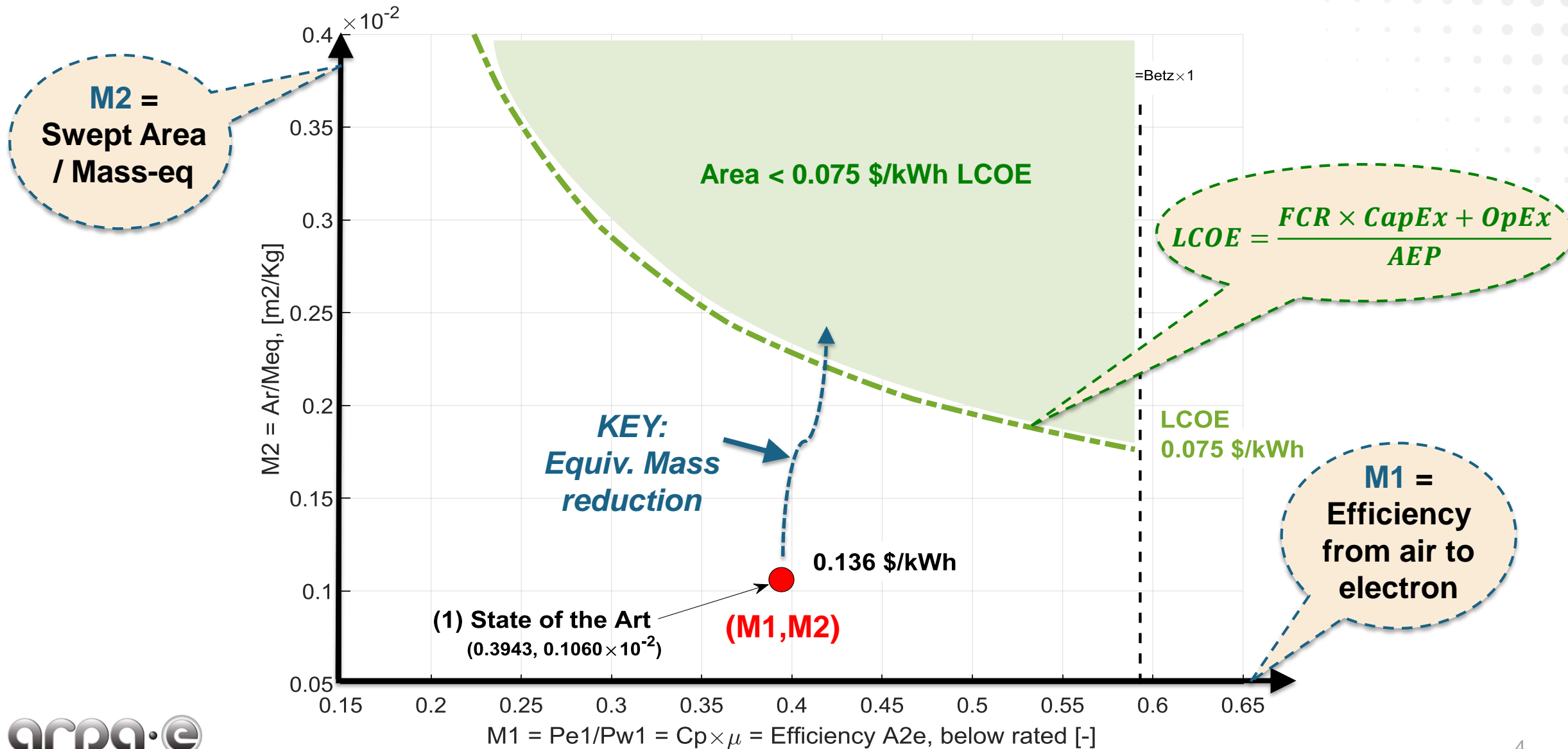
New space!!!!

Current attempts are still expensive...



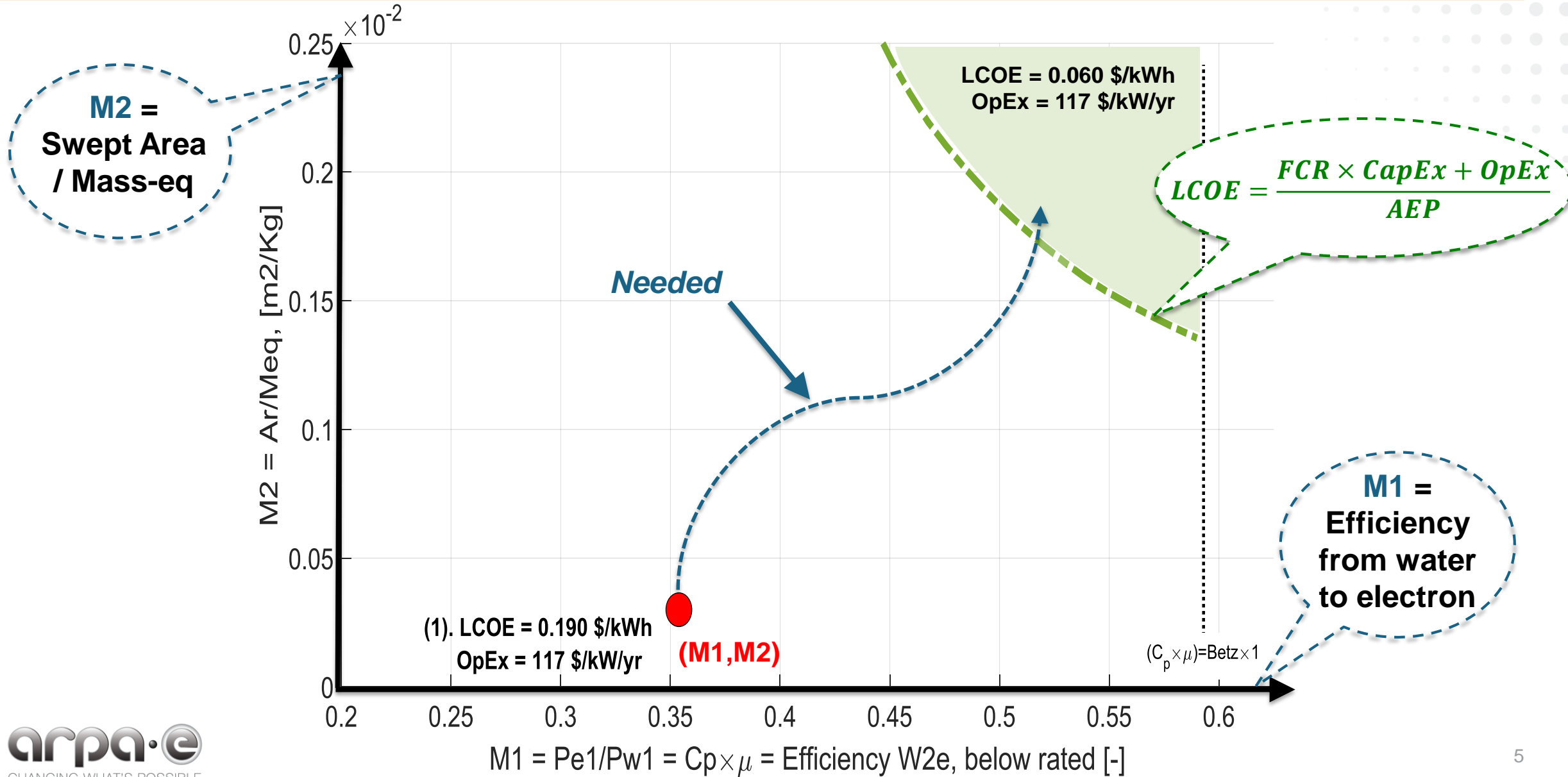
New Metric Space (ARPA-E, 2018)

ATLANTIS Program (2019)
Floating Offshore Wind Turbines



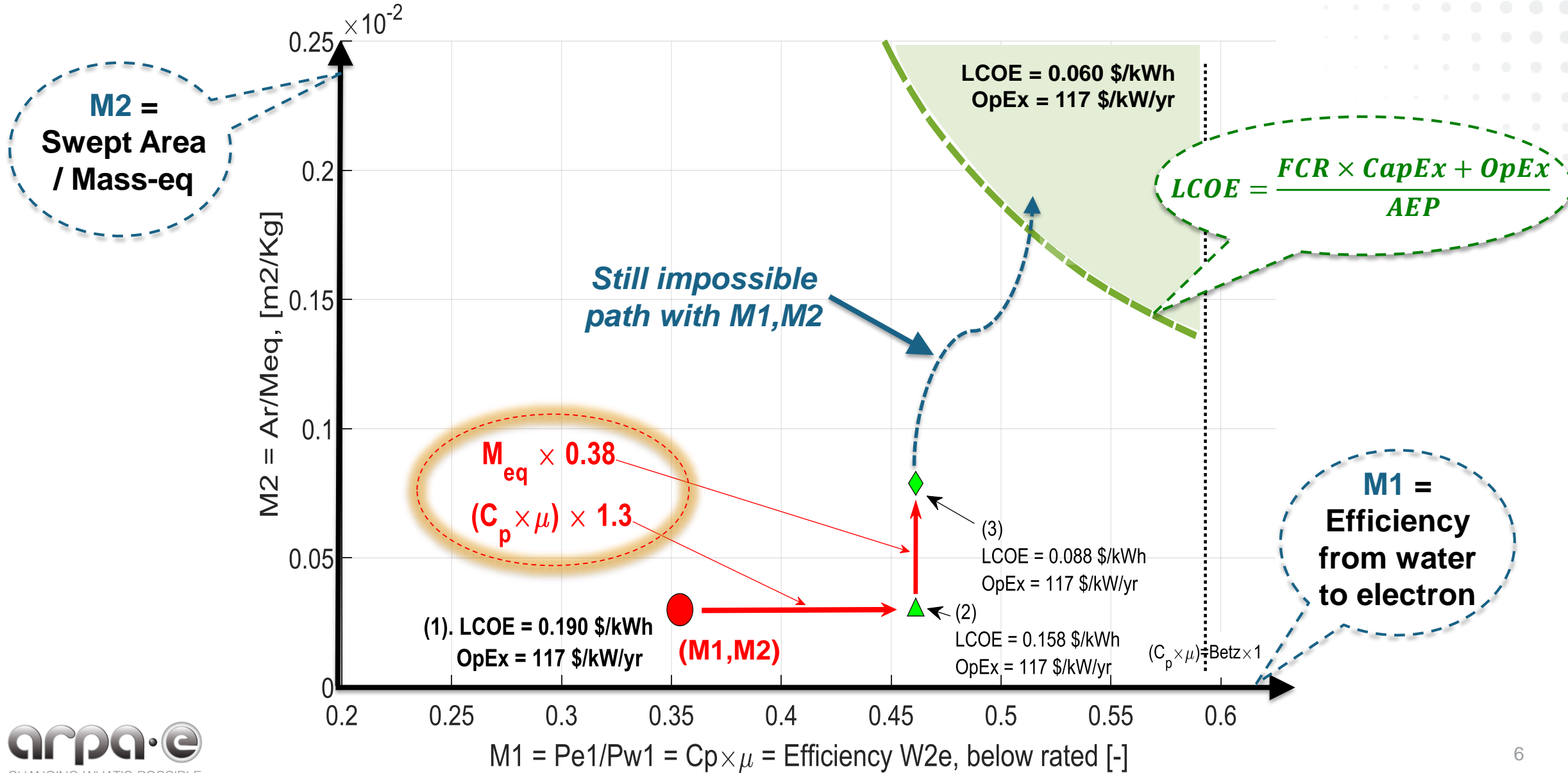
Metric Space (II)

Tidal Energy Systems



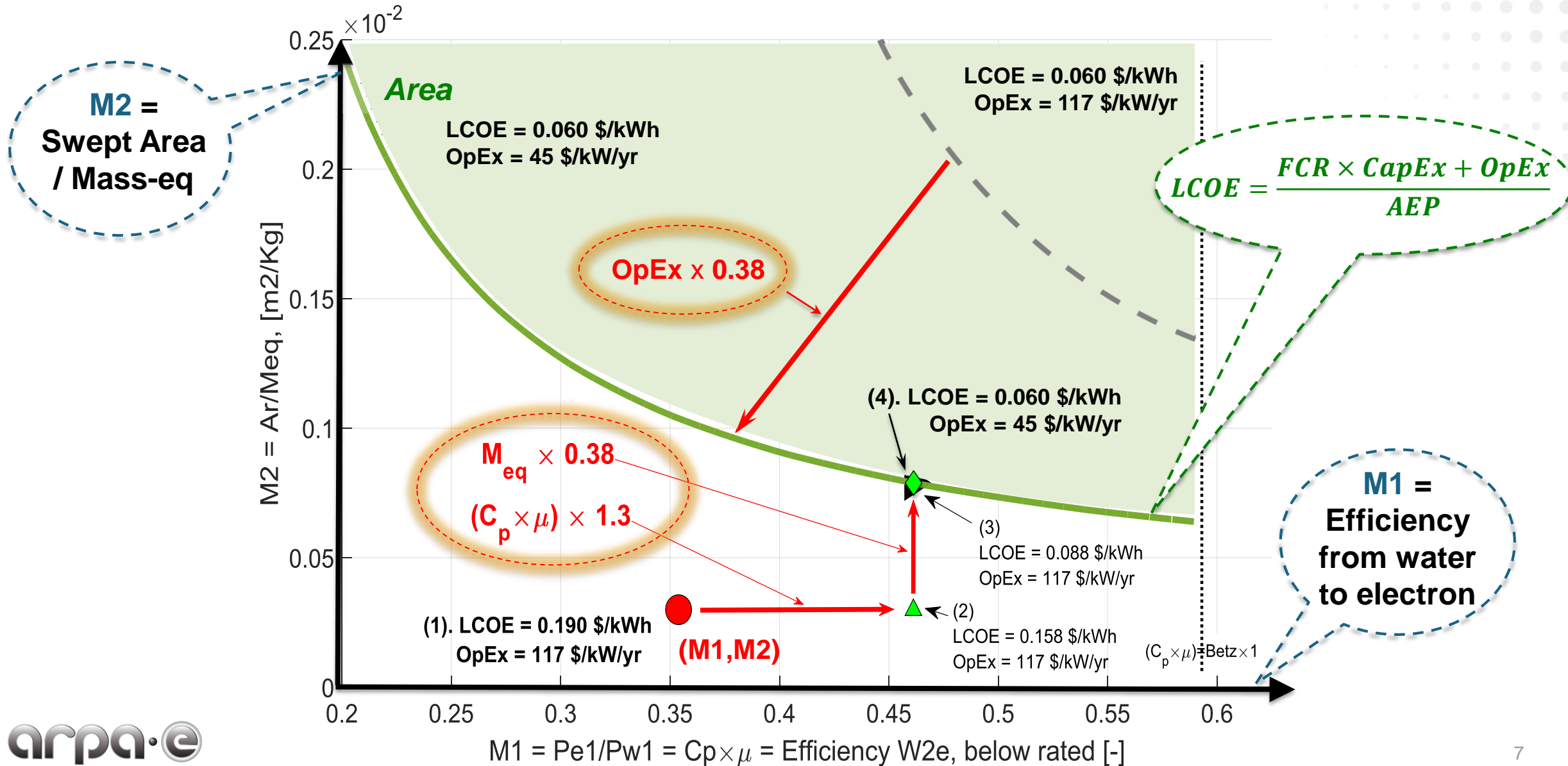
Metric Space (III)

Tidal Energy Systems



Metric Space (IV)

Tidal Energy Systems



Summary

For LCOE = 0.060 \$/kWh



1. **Operation & maintenance Expenditures**

$\text{OpEx} \times 0.38$

2. **Equivalent Mass** (mass, materials, installation, manufacturing)

$M_{\text{eq}} \times 0.38$

$(C_p \times \mu) \times 1.3$

3. **Efficiency** (water to electron)

Potential new ARPA-E program

Please send us
your comments!!

??

RFI. Open now!!!

OpEx, Eq.Mass, Efficiency

Tidal, Ocean current & River turbines

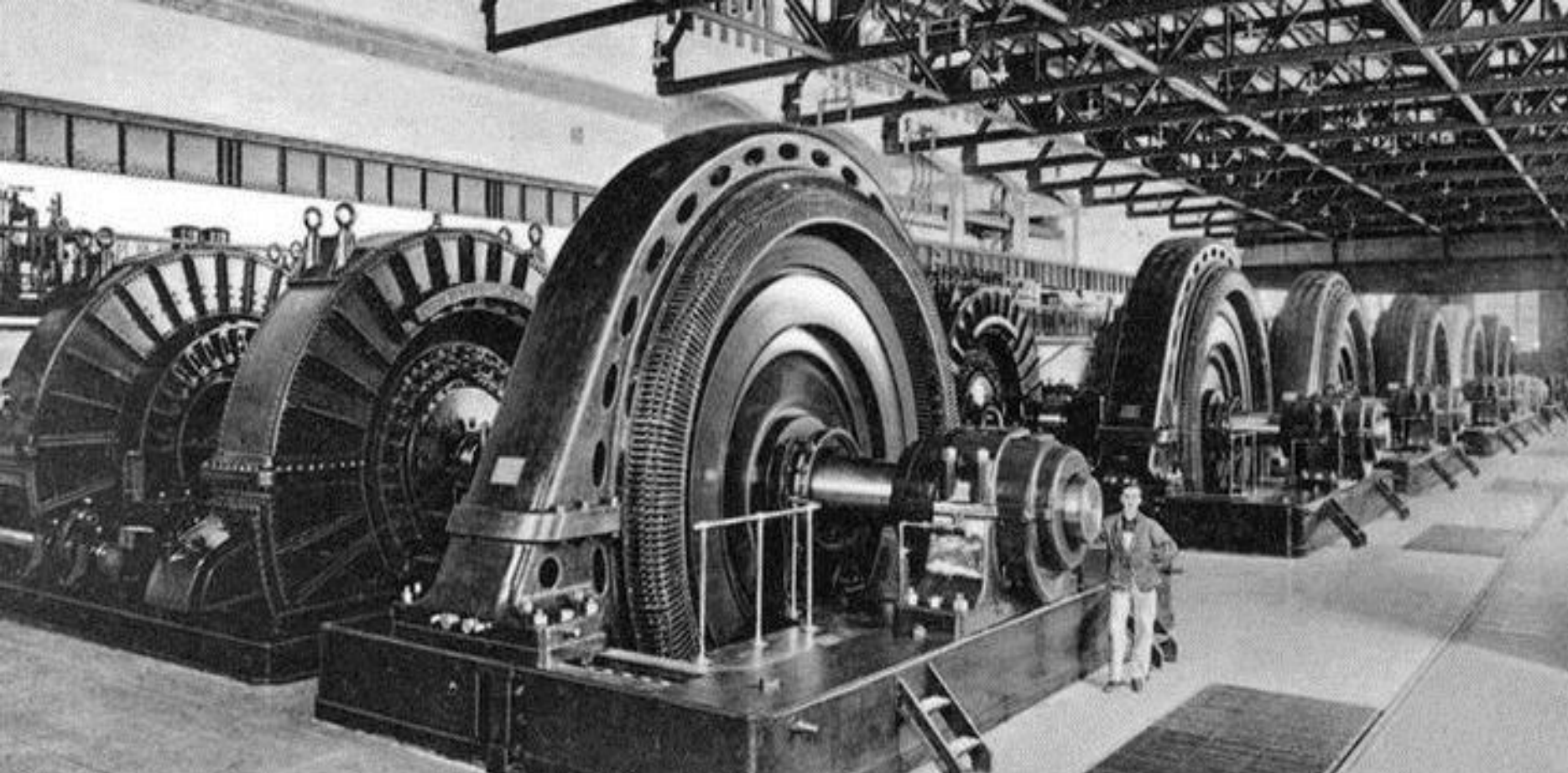
Control Co-Design, Concurrent Engineering

Designing for Installation, Operation & Maintenance

Program Areas: New Designs, Computer Tools, Experiments

Fault-tolerance design, Self-installation, Predictive maintenance, Control...





Thank you!

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